e-GRO Edible Alert

Ryan Dickson
ryand@uark.edu

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Magnesium or micronutrient deficiency in basil? Don't be fooled!

Symptoms of magnesium deficiency can resemble micronutrient deficiency in basil, and can sometimes be tricky to diagnose. Figure 1 shows hydroponic basil where the top leaves on the plant have symptoms of interveinal leaf chlorosis (leaf veins stay green, spaces between veins turn yellow), which is a symptom of both magnesium and micronutrient deficiency, particularly iron and manganese. For many plant species, magnesium deficiency usually shows up in lower leaves whereas micronutrient deficiency appears in upper leaves near the shoot tip. However, magnesium deficiency tends to show up near the top of the plant in basil, which is actually the case for the plants in Figure 1.

This e-GRO Alert explains why magnesium deficiency shows up at the top of basil plants and how to differentiate from micronutrient deficiency. We also cover strategies for preventing and correcting magnesium deficiency in hydroponic and container basil.

Magnesium versus micronutrient deficiency

Magnesium deficient plants first develop symptoms of interveinal leaf chlorosis in fully expanded and mature leaves. This is because when magnesium uptake by roots is insufficient, plants can mobilize and transport magnesium from the mature leaves to the growing shoot tips and younger leaves. Conversely, micronutrient deficiency symptoms develop first in shoot tips and young expanding leaves, because plants cannot mobilize and transport micronutrients from the mature leaves.

Magnesium deficiency symptoms often appear lower on the plant for many species, because the lower leaves are often the most mature leaves. However, basil has a growth habit that produces mature leaves near the top just under the shoot tip (Figure 2). When magnesium deficiency occurs in basil, magnesium is transported to the shoot tip from the closest mature leaves, which are right under the shoot tip. Because symptoms appear at the top of the plant and close to the shoot, they are often misdiagnosed as a micronutrient deficiency.

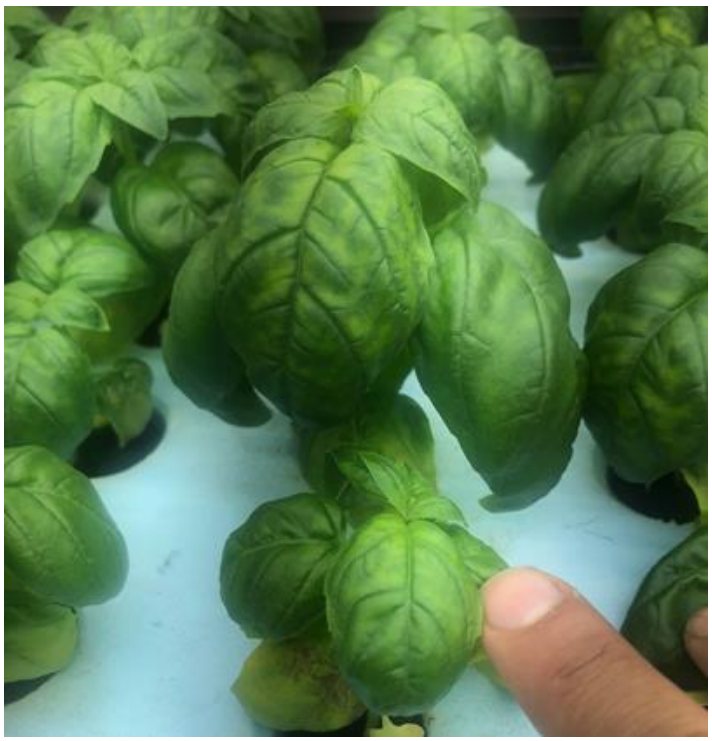

Figure 1. Interveinal leaf chlorosis in top leaves of hydroponic basil as a result of magnesium deficiency.

Making the right diagnosis

Diagnosing magnesium or any other nutrient deficiency requires a bit of detective work, and using a combination of several simple methods.

- Determine whether the symptoms are in the mature or the young expanding leaves. For basil, mature leaves can be at the top of the plant right below the shoot (Figures 1 and 2). In many other plant species, the mature leaves are at the bottom. Interveinal chlorosis in mature leaves, but not young expanding leaves, may suggest magnesium deficiency. Chlorosis in the youngest leaves suggests a micronutrient deficiency.
- Check whether sufficient magnesium is supplied by fertilizers and hydroponic nutrient solutions. Dolomitic limestone used in container substrates supplies magnesium for several weeks, but can become depleted in long-term crops. Irrigation water can also contain and supply magnesium.

Figure 2. Basil has a growth habit where stems elongate and the upper leaves are large, fully expanded, and mature. Magnesium deficiency symptoms in basil often show up in the largest leaves just under the shoot tip.

- For basil, Dr. Neil Mattson of Cornell University recommends between 40ppm and 60ppm of magnesium in applied fertilizer or nutrient solutions for container and hydroponic crops.
- If deficiency is suspected, send leaf tissue samples to a commercial testing laboratory for nutrient analysis. This way you can determine which nutrients are deficient or accumulating in the plant tissue, and use this to adjust your fertilizer recipe.
- Root diseases, such as *Pythium*, damage roots and limit nutrient uptake, and sometimes appear like nutrient deficiency. Always check root health when diagnosing nutritional problems, just in case the real problem is disease.

In hydroponics, other nutrients compete with magnesium for root uptake, especially calcium and potassium. A general rule of thumb is to supply a calcium:magnesium ratio of approximately 2:1 and a potassium:magnesium ratio of approximately 4:1 in the hydroponic nutrient solution to avoid a nutrient imbalance.

Nutrient solutions are often formulated using potassium nitrate (KNO_3) and calcium nitrate ($CaNO_3$) salts to supply adequate nitrate nitrogen. If potassium and calcium concentrations are too high in the nutrient solution, growers may consider using more magnesium nitrate ($MgNO_3$) and less KNO_3 and $CaNO_3$. This will help decrease potassium and calcium, increase magnesium, and maintain nitrate nitrogen concentrations.

To correct magnesium deficiency in container-grown basil, growers can drench plants with magnesium sulfate ($MgSO_4$) or Epsom salts at a 1-2 pounds per 100 gallon rate and switch to a fertilizer containing more magnesium. Magnesium sulfate (Epsom salts) drenches can be repeated every four weeks if needed, but keep in mind that $MgSO_4$ will increase the electrical conductivity (EC) or salt content of the root zone.

Basil appear to require slightly more magnesium than other leafy greens and herbs. For more information on magnesium deficiency in basil, check out the previous e-GRO Alert from Dr. Neil Mattson titled “Magnesium deficiency of hydroponic and container basil” (http://e-gro.org/pdf/E303.pdf).

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CONTRIBUTORS

Dr. Nora Catlin
Floriculture Specialist
Cornell Cooperative Extension
Suffolk County
nora.catlin@cornell.edu

Dr. Chris Currey
Assistant Professor of Floriculture
Iowa State University
ccurrey@iastate.edu

Dr. Ryan Dickson
Extension Specialist for Greenhouse Management & Technologies
University of New Hampshire
ryan.dickson@unh.edu

Nick Flax
Commercial Horticulture Educator
Penn State Extension
nzf123@psu.edu

Thomas Ford
Commercial Horticulture Educator
Penn State Extension
tgf2@psu.edu

Dan Gilrein
Entomology Specialist
Cornell Cooperative Extension
Suffolk County
dog1@cornell.edu

Dr. Joyce Latimer
Floriculture Extension & Research
Virginia Tech
jlatime@vt.edu

Heidi Lindberg
Floriculture Extension Educator
Michigan State University
wolleage@anr.msu.edu

Dr. Roberto Lopez
Floriculture Extension & Research
Michigan State University
rglopez@msu.edu

Dr. Neil Mattson
Greenhouse Research & Extension
Cornell University
neil.mattson@cornell.edu

Dr. W. Garrett Owen
Floriculture Outreach Specialist
Michigan State University
wgowen@msu.edu

Dr. Rosa E. Raudales
Greenhouse Extension Specialist
University of Connecticut
rosa.raudales@uconn.edu

Dr. Beth Scheckelhoff
Extension Educator - Greenhouse Systems
The Ohio State University
scheckelhoff.11@osu.edu

Dr. Paul Thomas
Floriculture Extension & Research
University of Georgia
pathomas@uga.edu

Dr. Ariana Torres-Bravo
Horticulture/ Ag. Economics
Purdue University
torres2@purdue.edu

Dr. Brian Whipker
Floriculture Extension & Research
NC State University
bwhipker@ncsu.edu

Dr. Jean Williams-Woodward
Ornamental Extension Plant Pathologist
University of Georgia
jwoodwar@uga.edu

Cooperating Universities

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